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CHARLES H. CLARK, *Managing Editor,*

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Editorial and General Offices: 65 Franklin St., Boston, Mass.

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The Editor's Page

TO make sure that the widest possible publicity is given to the most important features of the discussion at U. S. Institute's conference on textile drying, held in New York City, May 6, a very complete outline is being published in this issue. In conjunction with the conference papers, published in the June number and the bibliography in this issue, there is provided a more complete review of information on the subject than has been published heretofore.

UNFORTUNATELY, it needs but casual study of these papers, discussion and bibliography to demonstrate convincingly the lack or incompleteness of scientific information as to drying conditions that are safe for the different textile fibres, and that make possible maximum production within limits that are safe for fibre properties and the quality of finished goods.

IT has been estimated that a substantial start can be made in securing the scientifically accurate information that is lacking if $5,000 can be made available to U. S. Institute, preferably in individual subscriptions of $100 each. This is the co-operative basis on which U. S. Institute's warp sizing study was financed after the Textile Foundation had subscribed half of the $10,000 required. For $5,000 the largest and best equipped textile mill could expect to make little progress in a research on drying problems. U. S. Institute can, because for $5,000 it can secure personnel, equipment, materials and co-operation that would cost any individual mill five times that sum as a minimum estimate. This is confirmed by experience in the warp sizing study.

UP to July 1 subscriptions to this drying research fund were disappointing, particularly in view of the fact that the 150 textile men who attended the conference in May were unanimous in asking U. S. Institute to undertake the financing of the study. Less than 30% of the fund had been promised as of July 1. The response from the drying machinery builders, with only three co-operators, and from the control instrument firms with none, was difficult to understand. Wool and rayon manufacturers had shown the most substantial interest. There is no logical reason for any one class of textile manufacturers to feel that they are immune from drying troubles. They are all in the same kind of an unseaworthy boat, and the co-operative research offered by U. S. Institute is the cheapest and most certain method of securing the facts that will carry them to a safe harbor.

Drying Conference Discussion:

An Outline Report

BASIC to the discussion at U. S. Institute's conference in New York City, May 6, on textile drying were the seven formal papers on the drying of the major textile fibres and products, and on the theory and mechanics of drying. These papers were published complete in the June number of *Textile Research*. Also included in the latter was the explanation of the purposes of the conference by Mr. Eavenson, and the introductory and closing remarks of Chairman Emley. The complete stenographic report of the discussion was made available at $1.00 a copy and over 160 copies have been distributed, but this 15,000 word report, involving much repetition of queries for which no scientific answer exists and certain claims that were unrefuted because of the same lack of facts, was deemed impractical for general circulation in its original form. Additional copies may be obtained at the price noted by addressing the Secretary of U. S. Institute, and a summary of the outstanding features of the discussion, particularly of those which are controversial, which reflect the unscientific nature of general practice, and which endanger the quality of the dried product, is herewith attempted.

Can-Drying

With but few exceptions the discussion was confined to principles and problems of air-drying, and as can-drying usually lacks air circulation and involves certain factors foreign to air-drying, it must be understood that the discussion, unless specifically noted, applied solely to the latter.

Near the close of the discussion period one of the speakers called attention to can-drying as follows: "From the discussion so far you would hardly know that there was such a thing as can-drying in the world, and as far as the acetate manufacturers go, I think we would be very happy if there weren't such a thing as can-drying in the world. I think most of the other rayon manufacturers or handlers would agree with me on that point, but I wonder if we can bring out anything as to the effect of can-drying on the fibres. I presume the question fundamentally there is a dry-bulb temperature problem, because certainly your fibre as it goes over a can very quickly attains the temperature of the can. It is a wet-bulb temperature as long as there is any moisture evaporated. There is one factor on which I would like to have an expression of opinion; namely, whether there isn't an explosive or a pop-corn effect on fibres in can-drying where your wet fibre is suddenly, almost immediately, brought to a definite high temperature while it is saturated with moisture which can be turned into steam inside of the fibre structure, and what that may do to our fabrics in comparison to this question of air-drying which has been discussed so far."

Among the answers to this query were the following: "I would like to answer in this way: General experience would show that the can-dried

fabric has a much harsher finish than an air-dried fabric. Why this is so is a question."

Ans.—"Just one suggestion from an allied field. Paper drying is almost entirely can-drying. In paper drying it has been found essential for quality that the first cans be maintained at lower temperatures. High quality papers are dried on graduated dryers, and it is necessary to maintain the temperatures low for the initial heat."

Ans.—"In the drying of cotton warps we know that if our temperatures run too high the warp is very harsh. The fuzz of the yarns sticks together and prevents the opening of the warp in weaving. However, if we keep those temperatures low we are able to handle the warp in a satisfactory manner."

Ans.—"There is an example of can-drying where, because of overdrying, 18 hours was required for cooling off on woolen goods, and when they were sent to the nappers and shearers there was so much brittleness, at least in the surface fibres, that there was considerable shrinkage and loss. They found that after the drying the dry weight of their goods was 22 oz., while they were shipping regains to the commission merchants here in New York City at an average of 26 oz. It ran about 30,000 oz. a year. They figured their excess cost at six cents an ounce, so you can see they were sending along $1800 worth of something, maybe just moisture. They have installed in place of the can-dryer a modern cloth tentering machine which not only has saved them that loss, but they have also benefited by a reduction in steam consumption of $450 a year. They have reduced their drying time four hours a day. They have increased their output approximately 35%, and they have saved approximately $1100 in labor attendance of the machine."

The lack of general discussion of can-drying, and failure of any of those present to speak in its defense, seemed to indicate general appreciation of its shortcomings in the production of quality goods. Can or contact drying, however, is practiced on a large scale, has the economic advantage of quantity production in minimum time, and cannot be sidetracked in a comprehensive study of textile drying. Consideration in the latter of the possibilities of a combination of can- and air-drying is indicated as worthwhile.

Drying of Coated Fabrics

Another type of textile drying that was touched upon by only a few speakers, and by them only in its relation to crease-proofing, is the drying of fabrics coated with such materials as starches, rubber, latex, linseed oil, pyroxylin, etc. Usually such coating and its drying is a final finishing process, and little is known as to whether or not the textile materials are damaged. The variety of this type of finished fabric seems due for a large increase as new uses for synthetic resins are discovered. That part of the discussion relating to the drying at high temperatures of fabrics treated with synthetic resins raised several interesting questions that were not answered definitely, but should be. It was in part as follows:

Ques.—"I should like to ask if anything is known about the effect of temperatures in the curing process of anti-creasing on rayon fabrics and rayon blends. We are making fabrics of rayons blended with wool and these fabrics are being anti-creased, requiring quite a high temperature to fix the resin, and as far as I know nobody has made any attempt to find

out what the effect is on these fibres. They are just interested in obtaining anti-crease properties. My feeling is that these high temperatures are reducing the wool content and the resiliency of the fabric. I should like to ask if any of the machinery manufacturers or any others have any definite information on that subject."

Ans.—"The question of anti-crease is rather a new problem and is not concerned in one sense with the quality of the finished fabric. This anti-crease finish which is applied to the fabric and the drying are the final stage of processing. Consequently we don't know what the effect is so far as any qualities of the rayon itself are concerned. One of the statements that has been made by some people who are advocating the use of these finishes is that the material tends to cover over and seal some of the pores of the fibre and in that way retain the moisture which is inherent in the fibre itself, thus acting as a protection to the actual disintegration of the fibre. I mention that more in the light of a theory than as a fact at the present time, because work along that line has not been done so far as I know. I don't know whether that answers the question or not."

Ans.—"As to this question of synthetic resinence and the dry temperatures, which are undoubtedly the most extreme conditions that textile fibres meet in drying problems, I think the only answer to that is to beg our good friends who make these resins to give us some that will set at lower drying temperatures. There is no moisture present and the only controlling factor is the temperature at which those resins are set."

Ans.—"I know of a woolen manufacturer who is putting through goods treated with one of these synthetic resins at 400° F. without apparent harm. I have seen woolen stock damaged very materially by too slow drying at 180°."

Ques.—"How are we going to reconcile the fact that in anti-crersing we have a dry fabric going into the machine and we are not going to dry the fabric at all but are just going to subject it to high temperatures? The wet bulb is not going to give us any indication at all, is it?"

Ans.—"On the question of high temperature which is tied up with high velocity, we have seen tenter-frames go from 5000 feet a minute up to 100,000 or better, and temperatures from about 180° up to 340° in a very few years. The machine builders have got quite a problem on their hands. At high temperatures you begin to evaporate lubricating oil. You do it very rapidly. That becomes a problem, not only on the machinery but on the goods. I think this whole drying problem so far as cotton is concerned is much more than simply removing moisture."

Ques.—"On cotton you say you run up to a temperature of 340° now?"

Ans.—"What the temperature of the cotton is I don't know, but on the entering air we at times go up to 340°."

Case-hardening of Fibres

Ques.—"Reference has been made to case-hardening of fibres on drying. I am wondering if there is any criteria of a case-hardened fibre that would be useful."

Mr. Angus.—"I believe I made reference to case-hardening in my paper. I think I was the only one that did. Case-hardening of fibre we know does happen in some vegetable fibres and also to wool. In general, if it happens in one fibre there is reason to believe that it happens in others,

for this reason: there is a hardness which occurs in these fibres under high temperatures. If it occurs in one and causes stiffening and hardening, I would say, as a guess—it was the purpose of my paper to raise the question of whether it does or not—that it would occur in all of them. If it does occur, we all know the results: brittleness and hardness and internal stresses and dozens of things that cause later trouble. That was, I think, the only reference I made to it."

Ans.—"What Mr. Angus has said I can say from our experience has been proven on cotton and on wool and on rayon. With improper drying you have a certain larger percentage of moisture in the heart of the material than on the surface, as is proven by deposits of films on the outside such as sizing films. Unless you have graduated drying so that it is at a rate that will permit smooth drying throughout, you will get that hardness which is a case-hardening and is the cause in subsequent processes of inferior products; whereas, if that condition is corrected, you retain the natural elasticity and flexibility of the material."

Ans.—"On the question of case-hardening, the question is, what is it? Why? I think the physical evidence of case-hardening occurs in practically all fibres. In wool particularly you can notice it. That case-hardening is undoubtedly due to the effect of a high dry-bulb temperature searing over and closing the fibre cells."

Critical and Safe Drying Conditions

The balance and major part of the discussion was confined closely to air-drying with specific relation to what are safe and dangerous conditions for the various materials. Much of the discussion involved questions relating to the papers read at the morning session, all of which were published in the June number of this magazine. Answers that merely duplicated information contained in those papers are omitted in this outline report. They related largely to drying principles and theory. That part of the discussion relating to safe and dangerous drying conditions for the various textile materials, and which emphasizes the lack of exact scientific data on the subject, is reported quite completely in this outline.

Many of those who took part in the discussion were not identified by name in the stenographic report, and this outline report is therefore similarly deficient. It is a result of U. S. Institute policy of stimulating free discussion at conferences of this character by the promise of anonymity if desired. No one took advantage of this offer at the drying conference, and the stenographer is solely responsible for failure to identify all of the speakers.

Ques.—"Did I understand that in wool there is quite a bit of free moisture present which will be evaporated before the so-called critical moisture content is reached? Most of the speakers have said that the drying will take place at the wet-bulb temperature while this free moisture is present, and I would like to ask if there is any definite wet-bulb temperature which they feel is comparable to the wool or other fibre?"

Ans.—"If you have a high wet bulb, you have a high relative humidity. And so long as you have a sufficient wet-bulb depression to effect evaporation, and as long as the maximum free water is available, you won't have any damaging effects from the wet-bulb temperature."

Chm. Emley.—"I find from the notes that I made on the papers as

they were delivered this morning (although these may not be correct) that for rayon 130° F. was mentioned as being a safe temperature; that for silk 160 to 190° F. is the customary temperature although 230° is still considered safe for silk hosiery. In as much as the paper on silk this morning dealt with hosiery only, I am wondering if Mr. Wood would have something to say on the question of drying of silk fabric.''

Mr. Wood.—''As far as the dangerous temperature for drying silk is concerned, I think, considering that silk is aged when it is printed at temperatures as high as 230° at times, more generally 216°, a temperature of 230° possibly would not damage the silk. However, one has to remember that temperatures of 230° might also in the aging carry with them a dampness that you wouldn't find in the dry box. I think that drying a piece of very wet goods at a high temperature is a very different thing from drying a piece of almost dry goods, or perfectly dry goods, and maintaining that dry high temperature. Mr. B. was asked what the temperature in water would be that would damage any of these fibres. I think that varies with the fibre. I think with cotton you can probably go a great deal higher than you can with wool, for instance, because wool is probably dyed 45° C., and most of the other fibres are dyed at the boil. But when they are aged those temperatures are exceeded by at least 20° at the most. There was a statement made this morning which I won't say I doubted, but I would like to hear discussion from some of the members of this meeting who know more about it than I do; that is, that it didn't matter what temperature you applied (I heard some temperature mentioned of 350°) so long as your fibre was wet. I don't know. I think that is a rather controversial subject, and I would like to hear some expression of opinion from members who have made extended experiments in that direction. I must admit I haven't done very much research in that line. I have tried to control the humidity of the ager by means of wet and dry bulb and have not been very successful. But as far as the dryer is concerned I haven't really very much to offer. But I would like to hear the subject discussed if we can have it discussed, Mr. Chairman.''

Mr. Ditton.—''Before coming to this meeeting I made some experiments with drying some hosiery fabric in the dryer at temperatures of 180° on goods left in four minutes, 180° for eight hours, and 230° for three hours. At 180° for four minutes the break in grams of the fibre, after having been unraveled from the fabric, was 164 g.; at the end of eight hours, 167 g.; and at 230° for three hours, 163 g., which was a different sample of fabric; that slight variation to be accounted for by normal variation in the silk. The elongation percentage was 15% for four minutes, 16% at eight hours, and 15½% at the end of 230° for three hours. In other words, within that range regardless of time there is no appreciable change.''

Chm. Emley.—''Does that tie in with the statement Mr. Eavenson made about wool? Was any susceptibility to damage developed in silk by this heat treatment?''

Mr. Ditton.—''That I can't answer because in our process there are no subsequent operations such as dyeing which might affect it. In other words the merchandise is finished when it is dried. Nothing else is done with it.''

H. W. Butterworth, Jr.—''I think that so long as the evaporation rate is maintained at a rapid rate, the high temperatures applied to wet fibres

will do no harm. I happen to have had some experience which is practical. I am not a theorist. I have no notes, so if I slip up on some of this stuff just forgive me. We developed a dryer some years ago. We built only one. No attempt was made to economize on steam. We were interested in a quality job. It was on woolen fabrics. The dryer was built so that the cool air was drawn on the dried fabric in the bottom of the machine, and gradual increase in temperatures applied as the air circulation reached the wet fabric at the top of the dryer, at which point our temperatures were as high as 260°. Previous to the installation of this dryer they were using a very old-type machine. The exhaust from that machine was an acrid smoke. It would burn your eyes. You couldn't breathe. When we started in with this other type of drying machine the air came out cool and had a nice woolen smell to it. There were no evidences of any disintegration of any of the woolen fibres in that machine. A peculiar thing happened. In their napping operations they found they were getting 3 to 4% over-weight in their fabrics the minute this dryer went into operation. They had to lighten up on their yarns to the extent of about 4%. They were losing nothing in the form of broken fibres. The appearance of the fabric, the handling of the fabric and the whole general feel of it were so entirely different that they had to actually re-educate their salesmen on the use of those fabrics. Since that time we have been building a number of dryers for knit fabrics where we introduce hot, dry air on the wet fabric. The fabric is brought through the machine in horizontal layers and we rebuild the temperature on the second air pass of the machine. But we drop from about 240° at the entering into the dryer to about 118°. We are building up a humidity in the drying air as we are taking moisture from the cloth, so that in the lower end of the dryer we are using very wet air of low temperature to complete the drying cycle. In that type of drying it is almost impossible to reduce the moisture content of the cloth below its normal moisture content, and due to the very high velocity and huge quantities of air we use in those machines we are drying at the wet-bulb temperature throughout the cycle. I am not prepared to state what the economy is. We weren't interested. We were interested entirely in a quality job.

"I think it is not always easy to build a machine, particularly a straight tentering machine, where that principle of drying could be applied. Today, machine builders are being constantly asked for higher drying speeds. They have trouble finding lubricants that will stand up at those high temperatures. I had experience in one mill where they were drying heavy knit fabrics twice over dry pipes. In the second operation of drying the fabric was so dry that it would not regain by test its normal moisture regain even though it was stored in a highly humidified room for 48 hours or more. In my opinion, from a practical standpoint, there is something done both to cotton and to wool that prevents a normal action of the fibre after it has been over-dried.

"I think it is a correct principle of drying any kind of a fabric or fibre that if you drop your temperatures as the moisture leaves the material, and at the same time do not recirculate air or attempt to regain any temperature from that machine, I don't think any fabric can be harmed or hurt. That, in my opinion, is the basic principle of correct drying. Where you apply circulating air so that air conditions on the fabric at the delivery part of the dryer are the same as applied to that fabric when it is wet, under prac-

tical working conditions it is impossible to train employees to maintain the speed of that dryer so the fabric has just been dried before it leaves the dryer. I don't know whether that answers the question or not."

Mr. Hopkins.—"There have been several remarks regarding dryers designed for economy and quality, some apparently feeling that perhaps those two don't go hand in hand. I notice that the dryer manufacturers have put stress on economy—economy of heat, economy of space and so forth. Perhaps the reason they have done that is that they have found in dealing with manufacturers like myself they can find a more receptive attention to their arguments on economy because they can't quote figures of the effect on quality. We will generally agree that if you dry at low temperatures the effect on quality is ideal, while if you dry at higher temperatures your economy goes up. I think what we really want to do is to find what are our critical temperatures. There is no sense in drying at 80° F. if we can dry at 120° with great economy. Apparently from our own work there are three critical temperatures: One is a critical temperature on dry fibres; one is the critical temperature on the wet fibre; and then apparently there is another critical temperature on fibre when it is on the borderline between dry and wet. I think it is particularly susceptible to chemical damage when it is on the point of becoming dry. If anything could come out of this meeting where we could develop some actual data on critical temperatures, then we can tie up the influences of economy from the price point of view and economy from the quality point of view."

Mr. Hazard.—"All that was just said, I think, resolves itself into one thing. If the premise is taken that we work from a basis of wet-bulb thermometer and not from the dry-bulb thermometer, we will have something which you can really depend on as being uniform. For example, if your fibre has a certain wet-bulb thermometer reading which is caused by your evaporative cooling, your dry-bulb temperature, you might say, runs wild. Now as long as you have a flow of moisture from your fibre that gives you that result and the wet-bulb thermometer condition or depression which is safe for that fibre, you have nothing to worry about as far as damage occurring. But when your free water in the fibre is discharged and you commence to break down and discharge out of what you might call your cells, the knee of your drying curve, from then on your dry bulb will get in its effect, and that is where your damage occurs, and the tendering of the fibre commences and all the un-uniform things start which produce low quality. That has been our experience over a great many tests. The tests have been on wool and on cotton and on rayon. Those tests have not been on silk. But I would assume that silk, being an animal fibre, as is wool, would be similarly affected."

Mr. Ditton.—"In the drying of the silk when it still has its gum content, that is before the gum has been boiled off, we operate the dryer with a dry bulb of about 160°, wet bulb around 130°. The material goes into the dryer with a moisture content of about one pound of moisture for every pound of silk. It comes out with about 15% moisture. We have found that is absolutely safe because it is about 4% higher than the normal 11% reading. On some reverse operations, the steaming of silk to set the twist, we also use a dry bulb of 160°, but there the wet bulb is practically the same because we are attempting to put moisture into the silk and steam it. The danger is found, not so much in raising the temperature where the air would affect it, but where the silk is in contact with the metal heads of the bobbin

which would become overheated and there is danger of burning, but not from contact with the air alone."

Dr. Bonnet.—"There is also a danger of drying at too low a temperature. That seems rather anomalous after what has been said. One of the things that is quite necessary is to have the mechanical water or cleaning water removed from a fibre before it is actually sent to the dryer. In the case of rayon the scheme is usually to have the fibre contain approximately 100% moisture. That is to say, after the yarn has been properly whizzed it should contain as much moisture as there was originally bone-dry yarn, approximately that. The reason for the statement I am about to make is this: that if there is very much moisture in the yarn and it is then hung up in the dryer, the so-called wicking takes place which tends to pull the moisture that is evaporated from ends of the fabric or the skein, with the result that it carries with it either the sized material, or what-have-you, and there is a very uneven and unsatisfactory result which sometimes affects the yarn at those wicked places. So the general, safe factor is to whiz the yarn to such a degree that it does contain in the damp state about 100% moisture before it is actually sent to the dryer."

Ques.—"Have we any background at all through research or experience to tell us what are the proper specifications we should give the drying machinery manufacturers to build us a machine that will handle our work and bring it through in the best quality together with what economies they can show us? We all know in drying our goods we occasionally overdry, and we have tender goods, or in the case of dyed goods we have off-shade goods. And, personally, I am rather sorry we didn't have a dyestuff manufacturer here to say what the effect of heat would be on dyestuffs. Also, the discussion this morning concerned itself almost entirely with pure fibres. A lot of our drying is done after we have added the dyestuffs or sizing materials to these fibres. What effect does drying have on these materials that we use?

"Just to propound a theory on why perhaps we are getting tender goods: We have, as was said, a mechanical addition of water to our goods. We also have the natural moisture content of this fibre. It is a hygroscopic fibre and contains a certain amount of moisture. Where is the critical temperature at which we are discharging that moisture which belongs to the fibre, and perhaps through this discharge are blasting that fibre or wrecking its structure so that it is no longer able to regain the moisture which belongs to it? In other words, the theory of pop corn, if you will have just a common day theory: You have a certain amount of moisture in this kernel. You can dry this kernel out if you want to and have it retain the same form it had before. You can also put it into a popper and subject it to very extreme heat and burst it. Is that perhaps what is taking place in the fibres we overheat, and if so at what point should we stop and at what point should we tell our manufacturers of drying machinery to stop giving us machinery that will give us these great heats? In other words, we need a little education on both sides. We give a specification that we think is swell because it will do the job economically, or more speedily, and the machinery man builds it. But he has no background in the form of research to tell us we are on the wrong track in asking for things that are dangerous to ourselves."

Dr. Smith.—"This discussion so far has pointed to one definite contribution I think that the Institute could make to the industry. That

would be to collect information from these gentlemen on their experience as to safe temperatures on all of the fibres and perhaps on gelatin and starch; the safe dry temperatures and the safe wet temperatures above which some form of destruction or change would take place, studied in relation to physical properties, to the moisture regain subsequently, to the effect on dyeing and, if possible, on nap. Then I think we have already seen that one very definite research project would be to put somebody to work to try to definitely measure those temperatures on the various fibres."

Mr. Von Bergen.—"Everybody seems to forget the effect of chemicals on the drying process. In wool, for example, when we deal with raw stock, undyed, we have pH radiation from 7 up to 11. But in most of the wool scouring houses the wool will enter the dryer with a pH from around 9 to 10. When it is colored raw stock it will run as an average pH from 4 to 6. In cotton yarn we have the same thing. The white undyed yarn runs a pH of 8 to 10, whereas the dyed will be about 4 to 6. I think we must investigate the critical temperatures in connection with the chemicals present."

Anon.—"In connection with the critical temperatures as influenced by the chemicals, one of the speakers this morning mentioned the lowering of the vapor pressure. This is a very important factor and probably is more responsible for overdrying the material than any other. It simply shifts the critical point down the scale so that whereas for one dye a certain temperature is the critical point, and up to that point we could go by a wet-bulb temperature alone, for another dye we will have a different critical temperature and we have to stop with the wet-bulb temperature control at an earlier point. I think that a project of research would be for the Institute to delegate a committee to find out by what means research could be started on the variation in vapor pressures as influenced by dyes, sizing, etc."

Anon.—"A gentleman just mentioned pH values in connection with dyed fabrics. I haven't had any experience on textile materials where the pH value has played any part. I do know of an investigation on the drying of sewage in which it was brought out that with a certain change in pH they could or could not dry it. If the pH value exceeded a certain point they could not dry the sewage, and as long as it kept within various limits the water would come out free. Now it may be that pH may play an important part in the controlling of evaporation or drying conditions. I don't know of anybody who has undertaken investigation along those lines, but certainly it may lead to better drying and better quality products."

Anon.—"In connection with this whole problem it seems to me that we must not lose sight of the fact that everyone who is drying cloth is doing it to make money. If we are going to make an improvement in our equipment it seems to me the point is that the money we spend in putting in improved machines has got to show us a profit. Some of the speakers brought up the point that there was too much question about economy, but just the same if the machinery builder comes in and he has got a new dryer, the question of whether we buy it or whether we don't buy it depends on whether it is going to show us a profit. And there seems to be a great difference in opinion between different people, all turning out satisfactory material, as to how high the temperature can go and how high it can't go. The whole point of the thing is what is the cheapest way to turn out the cloth with a satisfactory quality. It seems to me that for a research proj-

ect the thing to do is to find out how much damage is caused by this overdrying, and also take into account that the woolen people talk one way and the rayon people talk another way, because maybe the woolen fellow is handling cloth worth $2 or $3 a yard, and the rayon fellow is handling something worth 20 or 30c a yard, and it might be cheaper for the rayon man to sell a small percentage of yardage at a loss than it would be to slow down his production. Therefore I should say that as far as the research project is concerned the important thing is to determine how much damage is caused by this overdrying in each particular kind of fabric."

Dr. Smith.—"I venture to say, although there are no figures to support this, that if the money that is spent by all of us in claims on goods that have been damaged by excessive drying could be applied to ideal drying equipment and drying methods perhaps that would solve the profit and loss element in this thing."

Ques.—"There is one question I would like to get a little clearer in my mind. Over-temperature and overdrying have been discussed. I would like to know whether they are the same thing or whether they are two separate effects?"

Mr. Angus.—"I would say that there are two separate problems. If the product goes down to the point where it is bone dry, it is one problem. If it is subjected to unusually high temperature and it doesn't get to its point of bone dryness, there is still evaporation to hold this same old wet bulb we are talking about, then it isn't injured from overdrying; it isn't injured from over-temperature. But I suppose there is a limit that it will stand under any conditions, because it is very hard to hold humidity at high temperatures on the surface of a product that is in itself so easy to give off its moisture. One little layer of cloth is one drying problem, where a blanket of raw stock is a thousand drying problems. It is thick and it is thin. While the mass of it, if you compress it to a known quantity, would stand so much temperature for so long; if it is thick in one place we naturally have got to overdry the thin part to get the top dry, just as this gentleman raised the question about his seams. That means a slowing down under humidity control, and that is the only way to do it."

Anon.—"I would like to add a few subdivisions to this general question. We are not only trying to get rid of moisture, we are trying to get a result on our cloth. I am speaking only of cotton. However, the cloth may be entirely cotton, or it may be that the cotton has gotten down to the same point as the straw in the bricks, and it is simply holding together a mass of other material to form after drying a hard baked garment. So the drying isn't only just a question of getting rid of so much moisture. I know in our own plant we have at times to actually case-harden our goods to get the desired finished result. I would like to get that attached to the question. Then again, most of us have to hold our machinery more or less in a universal condition so that we can finish a number of different fabrics without having too much specialized machinery for each type of fabric and finish, so that we can't reach ideal conditions. We have broken down some of our machines into multiple drying units, and then after thinking we have the ultimate we proceed to break them down much further in order to get results, because one fabric may have to dry very, very slowly although it would be possible to remove the moisture with extreme rapidity. We may want to do things with that fabric as we dry it. You are limited there, not by your drying, but by other things."

Mr. Eavenson.—"In all this discussion here today I was looking every minute for somebody to say, 'Well, that is perfectly all right as regards wool, but it doesn't mean a thing as regards cotton or silk or something else.' So I take it from that that there must be certain underlying truths or laws applicable not only to all of the fibres but to the various types of dryers and also cloth and yarn and so forth. And the object of this meeting, as I get it, was to determine that very point, whether there is one basic fundamental problem or whether it should be split up. Not a soul has recommended that it be split up. We have all spoken here in general terms. And it seems to me that the absence of remarks along that line does indicate that it is one broad general problem. If anyone else has other ideas than that I wish they would get up and speak about it because it is up to the Research Council to go into a huddle and see what we are going to do about it. We must try to develop something practical. We must lay before you certain plans. We must give you an idea about how we think it is best to go about it, and what it is going to cost before you can determine whether it is worth supporting or not. If it is one problem, all well and good. If it is to be split up I wish somebody would talk about it."

Dr. Chamberlin.—"I am getting tired of listening to wool mostly. I am more or less of a silk man. When we treat silk, basically what we are trying to do is hydrate it. We want to add a certain water of crystallization, or something. That is done in a soaking operation. We have comparatively little use for drying problems. Particularly in the hosiery business today we find out that if we can air-dry silk at very low temperatures we get better results in the finished fabric than if we try to force-dry. Many of our customers send ten bales of silk today and they want ten bales or equivalent weight in yarn delivered the next day. Sometimes it is necessary to force-dry silk. When you do it you have your fingers crossed for the reason that you must generally hear from it later. We hear from it in hosiery as a two-tone effect, due to oxidation of oils and other chemical materials that are put on and carried in the gum thread during that particular process. So we find out that the less we dry it hurriedly, the better it is. The idea is to keep away from fast-drying operations. I think if you will look through the silk industry you will find that the forced-drying of silk is very little practiced unless it is done at not too elevated temperatures over very standard and controlled conditions."

Dr. Bonnet.—"I am in rather hearty agreement that underlying this entire problem is this matter of humidity control, but exactly how it affects the various types of fibres is another matter. It seems to me that each one is rather specific. Wool is specific; it decomposes, as we heard this morning, under varying conditions. I should say that rayon does not behave in exactly the same way, nor should I assume that cotton did, although I suppose that cotton and rayon are much more nearly alike. Therefore I think that the problem which the Institute has is to devise means of collecting the specific data which apply to the different fibres."

Dr. Killheffer.—"Do you mean that specific data should be collected first before a conclusion is reached as to whether there is a central problem running through all of them that warrants an undertaking by this Institute?"

Dr. Bonnet.—"I would say that there was a fundamental problem underlying the entire discussion this morning involving all fibres, but that the specific problems are related to the specific fibres which we have been

discussing. For example, I don't think that rayon will decompose in the same way that wool will. As I cited this morning, if you dry with a dry-bulb temperature of 180° and a wet-bulb temperature of 134°, you get very satisfactory results; presumably the yarn has approximately 5% moisture left in it, and you could continue to dry it for some time. The length of time that you could dry the yarn or hold it at that temperature is not known. It is good enough for any type of ordinary commercial processes, but so far as I know we don't know whether, for example, heating it at 180° with 134° wet-bulb temperature for say over a day would be harmful to the rayon. We don't know that."

Ques.—"I think we are all pretty much agreed that humidity control at high temperature is important. Now the question is this: has anyone done any work other than Hartshorne, which was done I think back in 1911, on the question of regain on different fibres at high temperatures, wet- and dry-bulb temperatures? So far as I can find out, nobody else has, and Hartshorne's experiment was confined solely to cotton. If there is any other work done along that line I would be very glad to know about it."

Mr. Clark.—"There has been quite a little work done since then."

Previous Speaker.—"That was on cotton. How about the other fibres?"

Mr. Clark.—"I can only answer in this way; that not one of the reports I have been able to locate contains any data that have direct practical application."

Mr. Angus.—"I have a regain chart for cotton and wool running from 32 to 220° and I think it came from England. I don't know the author. It is rather interesting. There is quite a little difference in regain temperatures."

Ques.—"Isn't Hartshorne's work based on theoretical regain at high temperatures? I think the results are based on a theoretical equation which he thinks could be used at higher temperatures."

Mr. Clark.—"I think that is correct."

Ques.—"Can you just add a control instrument to your machine and be sure you are maintaining more or less the same regain, or do you have to have a new machine to do it? Can we add any instrument to the machine and obtain a condition of regain, we will say of 4% or 5%, so the product that comes out has the uniform condition?"

Mr. Hazard.—"You can apply the control and you probably won't get as good results as you do now, unless the machine is properly designed so the control will permit you to produce the uniformity that you want. I have known a good many cases where we have applied the control where the final results were not as good as when they operated without it, and the results were due to incorrect design of the machine itself. All your fine control equipment isn't worth anything unless the correlation with the other parts is in balance."

Anon.—"Mention was made about dividing the project between the different fibres. It seems to me that might be a very wise thing to do. What is done in the handling of wool, which is easily deteriorated and wastes a very valuable product, mightn't be at all a reasonable thing to do with rayon or cotton which is so much cheaper. For that reason, I think, aside from the fundamental research, that any practical application should be on the basis of each separate fibre."

Chm. Emley.—"I want to repeat the question which was asked earlier

in the meeting and which has not yet been answered satisfactorily to me, although the man making the inquiry has not seen fit to repeat it himself. Are we agreed that with these textile fibres there is some danger of damage when they are heated too hot in the presence of water, when they have too high a wet-bulb temperature?''

Mr. Buck.—''In regard to wet-bulb temperature in the presence of high temperatures; if you have an enclosure under atmospheric pressure with 212° dry bulb, and if you approach 212° wet bulb you have saturated steam; those conditions are probably obtainable only in a box or enclosure provided with saturated steam. I have never seen a dryer operating under atmospheric conditions with a dry bulb around 212° where we had a wet bulb approaching that. Now as your dry-bulb temperature goes up, the ascendency of the heat has a tendency to keep the wet bulb down. I have made a number of demonstrations (how much they are worth I can't tell) in tenter-frames and dryers, where we had temperatures from 250 to 350°. We get a wet-bulb reading, and what that reading is or how valuable it is I don't know. But I have never seen a wet-bulb reading over 115 or 120° under atmospheric conditions with a dry bulb in excess of 250°. That means that on a wet piece of goods carrying surplus moisture and going through the dryer the wet-bulb depression is affecting the evaporation so fast that it is doubtful if the temperature of your fabric exceeds by more than 5 or 10° your wet-bulb temperature. In other words, as long as there is water there you are going to have free evaporation, and with free evaporation absorption of heat, or refrigerating effect; this keeps your fabric temperature down and it increases only when there is insufficient moisture to maintain the essential refrigerating or cooling effect. If you have dry-bulb temperatures under 212°, then it is possible to get complete saturation or high wet bulb. But when you exceed that on all your psychometric charts, after you pass 212°,—well it is just merely a guess as to what you have. We do get a wet-bulb reading, but what it is the Lord only knows. We all say that above that temperature air has an infinite capacity for moisture. I know that Prof. Lewis of M. I. T. made a number of tests on paper machine dryers where the wet sheet was going over the hot drum, and he found that there was an increase in the temperature of the sheet of about five or ten degrees above what it was normally supposed to be. I don't know whether that answers your question or not.''

Chm. Emley.—''It answers half of it, Mr. Buck, but not the other half to which I would like to get an answer if possible. Starting out with your assumption that your wet-bulb temperature is about 115° and the temperature of the fabric might perhaps be 120°, if you take a wet fabric at 120° and keep it there for any length of time, is there any danger to the fibre? I can conceive that fibre with water at 120° F. might undergo some deterioration; particularly with a pH of 11 or 12 on wool you might get into some real trouble. So I would like to know if there is any danger of deterioration of the fibre when you have a reasonable wet-bulb temperature.''

Mr. Buck.—''I don't know of anyone who has made any investigation of the actual effect on the fibre structure under those conditions. We know the practical results, the practical answer. For instance, I think you have seen candy-makers stick their hands in a bucket of water and then put them into a kettle of boiling candy and pick out a sample and cool it off to see whether it is right or not. Certainly that film of water that is on his hand

for that instant in the high temperature provides a protecting film. Now at all these high temperatures we speak of—the gentleman spoke of 340° on a tenter-frame—the cotton sheet may go into the tenter carrying in excess of its critical moisture content, but it is only subjected to that temperature from 8 to 15 seconds, maybe less, in a high-speed frame. Under those conditions the temperature of the fabric does rise. It may run up to 150 or 160°. But when using high temperatures you are speaking in terms of seconds and minutes and not hours.''

Mr. Hazard.—''If you stop your flow of temperature over your heated surface you are going to hurt your goods even though your point of stopping is going to be a relative wet-bulb condition. At the present time we are drying cotton at temperatures 70° above those formerly used. But it was found that we have to introduce a speed factor to compensate for that increase in temperature, and we have to effect a cooling proposition so that the moment the flow stops the cooling starts, thus preventing degradation. Unless that is properly taken care of you will have a breakdown, although at the moment of stopping you would have a relatively low temperature. We have a wet-bulb temperature on cotton of between 150 and 160°, yet the actual dry bulb runs between 260 and 280°. Does that answer your question?''

Chm. Emley.—''That brings up another factor for consideration: the question of time. I am wondering if this whole proposition isn't becoming somewhat unified; that whether or not you get deterioration in the fibre seems to be dependent—that is, considering pure fibre without other materials—upon the moisture content and the temperature and the time, three factors, and that those three factors form the general law which applies to all fibres. Of course the factors would be different for each fibre, and of course they would be different for every other material which the fabric may contain, but fundamentally those three apply to all. Is that the consensus of opinion? That is a general idea that is worth carrying away.''

Mr. Chase.—''I would just like to add the factor of pressure. Probably that ought also to be considered.''

Mr. Hazard.—''Mr. Chairman, I have knowledge of some tests that were run along the lines that you just mentioned, but the point at which deterioration took place was different for different fibres.''

Chm. Emley.—''You would expect that.''

Mr. Hazard.—''So I think your problem is one problem.''

Mr. Eavenson.—''It seems to me that there are certain critical conditions peculiar to every fibre. We might go no further than to determine what those critical conditions are. Then it seems to me that the question of economy is a most important one, as has been mentioned. Certainly no one would design a dryer for a man making very low priced cotton goods along the same line that he would for wool or silk. The problems are different: the possibility of harm and degradation to the fibres being more severe in the latter case, and financial loss due to such harm would be so much more severe. But it does seem to me if we only go so far as to determine those fundamental things, then questions such as heat transference and circulation and what not become relatively simple engineering questions, and we have plenty of men who understand those questions very thoroughly who could work them out so as to design a machine to suit each particular need.''

Drying of Textile Materials:

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Compiled by C. H. CLARK*

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Drying Research Depends Upon Financial Support

"AS reported elsewhere in this issue, textile men who attended the conference held last month under the auspices of the United States Institute for Textile Research agreed unanimously that research on the drying of textiles is called for and that the Institute should undertake such an investigation. It appears certain, therefore, that research on this problem will be carried out.

"How quickly the project gets under way and how thorough an investigation is made depend upon the financial support given by the industry. Some companies have already expressed their readiness to contribute. *We feel certain that no concern which is engaged in textile processing can afford to pass up this chance to learn at the earliest opportunity those conditions at which drying of the various fibres can be carried out most efficiently and with the minimum amount of damage to the fibre.*"—Editor, *Textile World*, June, 1936, P. 132.

Abstracts

This section is compiled under the direction of the Committee on Abstracts and Bibliography: Prof. E. R. Schwarz, Chairman, M. W. Weiss, Dr. Irving J. Saxl and C. H. Clark.

I. Fibres (Synthetic and Natural) and Fibre Analysis

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The author describes tests on three types of Brazilian and two of Argentine cotton compared with American middling 1 inch, the tests having been made at the Royal Research Dept. for the Paper and Vegetable Textile Fibre Industries, Milan, of which he is director. (C)

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A sample of cotton and a sample of staple fibre are compared in regard to strength, extensibility, staple length, fineness, structure, regularity of staple and flexibility, and the spinning value of cotton-staple fibre mixtures is briefly discussed. (From *J. T. I.*, Nov. 1935, P. A580.) (C)

Delustering of Rayon and Cellulose Acetate. C. L. Moore. *Rayon & Mell.*, 1936, Feb., P. 69; March, P. 47.

A general review of the methods and the theory of luster. (C)

Dimensions of Micelles of Cellulose Fibres. U. Yoshida and N. Matsumoto. *J. Soc. Chem. Ind. Japan*, 1935, V. 38, P. 187B.

As measured by the plastic elongation, the size of the micelles of a viscose rayon was 560 by 56 Å, and was independent of the filament denier. (From *Paper Trade J.*, Feb. 13, 1936, P. 36.) (C)

Dissolution of Chemically Modified Cotton Cellulose in Alkaline Solutions. II. Comparison of the Solvent Action of Solutions of Lithium, Sodium, Potassium, and Tetramethylammonium Hydroxides. G. F. Davidson. *Shirley Inst. Memoirs*, Nov. 1935, P. 43–62; *Cotton Literature*, Feb. 1936, P. 53. (C)

Handling of Cotton with Cotton in Place of Jute. W. Lawrence Balls. *International Cotton Bulletin*, July, 1935, P. 633–40.

A paper read at the International Cotton Congress, Rome, May, 1935, giving the author's views and a general discussion of the technical and

economic problems due to the use of hessians (jute) for cotton-picking bags and the covering of cotton bales, and those that must be met in the substitution of cotton for jute bagging. Tests indicate that "the substitution of cotton-handling for jute-handling would only just pay for itself in 120s at the spinning machine. In coarser counts the advantage would seem, on the surface, to be with jute, or that the saving, due to decreased ends-down, etc., on 40s yarn from Egyptian Uppers would be trivial. The author, however, is strongly in favor of cotton handling for all Egyptian cottons, being confident that the extra cost per bale (750 lbs. approx.) of 5 s. will pay for itself in all counts spun therefrom. (C)

HUMIDITY OF RAW COTTON AND THE DETERMINATION OF ITS MERCANTILE WEIGHT. Camillo Levi. *Interntl. Cotton Bull.*, July, 1935, P. 732–43. (C)

LANOLINE: RECOVERY OF—BY EXTRACTION FROM WOOL-WASHING WATERS. M. Seriakov and N. Paramonova. *Maslob.-Zhirov. Del.*, 1934, V. 9, No. 5, P. 39; *Chim. et Ind.*, 1934, V. 32, P. 1406 (through *Water Pollution Res. Bd. Abs.*, 1935, V. 8, P. 359); *J. T. I.*, Nov. 1935, P. A588. (C)

LIGNIFIED FIBRES: X-RAY PATTERNS. W. T. Astbury, R. D. Preston and A. G. Norman. *Nature*, 1935, V. 136, P. 391–2.

X-ray photographs have been obtained with manila hemp at different stages in its purification from xylan (initially 19.8%) and also of common fibres not so rich in xylan. The purification processes generally resulted in clearer diagrams but no fundamental changes were observed, thus supporting an earlier view that the xylan molecules form a kind of mixed crystal with the cellulose molecules. (From *J. T. I.*, Nov. 1935, P. A580.) (C)

LIME SOAP FORMATION IN SILK SOAKING AND ITS TREATMENT. J. M. F. Leaper. *Tex. Col.*, Jan. 1936, P. 13–15, 60. (C)

RAYON: PRODUCTION OF—FROM ALBUMINOUS PRODUCTS. G. Salzmann. *Mell. Textilber.*, 1935, P. 705; *Rayon & Mell.*, Feb. 1936, P. 86.

The author gives a brief account of a great many experiments. Millar and Dye were the first to attempt to produce silk-like threads from albumin by dissolving gelatin, glue, and isinglass in water, thickening the solutions, treating them with softening agents, decomposing them with glycerin or castor oil, and finally spinning in air, after which the threads were hardened with alum or the like. This so-called "Vandura" silk, however, did not meet expectations. E. Todtenhaupt took up the problem, starting from casein which he dissolved in aqueous or alcoholic solutions of alkalis. He too was unsuccessful. All the processes that start from fibr[illegible] keratin are sure to offer more chance of success. The process of [illegible] Japanese investigator Kabushiki Kwaisha is said to have yielded es[illegible]ially tough strong fibres. It consists in dissolving silk in a concentrated solution of magnesium nitrate and spinning at a low temperature in acetic acid or methanol. The I. G. Farbenindustrie A.-G. has also taken up the problem, making use of phosphoric acid, which dissolves fibron at ordinary temperature producing a remarkably stable solution. (C)

RAYON STAPLE FIBRE: DIRECT PRODUCTION. F. Ferrand. *Manchester Guard. Comml.*, 1935, V. 31, P. 173.

The establishment of a new company, Ferrand's Staple Products Ltd., is announced to manufacture staple fibre by a direct process in which the flow of viscose is intermittently intercepted by means of air. (The process appears to be that covered by E.P. 308,645.) (From *J. T. I.*, Nov. 1935, P. A553.) (C)

RAYON: X-RAY STRUCTURE. O. Succolowsky. *Leipz. Monats. Text. Ind.*, 1935, V. 50, *Fachheft II*, P. 34–7.

A general discussion of the results of X-ray studies of the structure of rayon filaments, the differences in structure between rayon and natural fibres, and the relation between the structure and strength of rayons. (From *J. T. I.*, Nov. 1935, P. A581.) (C)

II. YARNS AND FABRICS

DRYING: EFFICIENCY IN. *Tex. Mfr.*, Jan. 1936, P. 17.

The following questions are answered regarding wool yarn drying: (*a*) Is the air discarded before it has absorbed the amount of moisture it can take up? (*b*) How can the correct exhaust speed be determined for varying conditions of temperature? (C)

"DURON ZONOL" RAYON SIZE. J. E. Fea. *Silk and Rayon*, 1935, V. 9, P. 501–4.

Rayon sizing may be of the siccative (or adhesive) type, produced by gelatin-starch sizes, in which the final arrangement of the cloth takes place in the woven state, or of the cohesive type, given by oils, in which the bulk of the arrangement occurs progressively during the construction of the cloth. Linseed oil is unsatisfactory, because, owing to oxidation, its removal is difficult, but water-soluble organic ozonides, produced by electrical treatment of oils, form suitable sizing agents. The sizing properties of Duron Zonol are discussed, and it is claimed that by its use such faults as stripiness and canage are avoided. Samples are shown of rayon fabrics sized with this agent. The improved handle is particularly noticeable. (From *J. T. I.*, Nov. 1935, P. A562.) (C)

FAULTS IN TEXTILE FIBRES AND MANUFACTURED GOODS, THEIR DETECTION AND EXAMINATION. A. Herzog and P. A. Koch. *Mell. Textilber.*, 1935, V. 16, P. 561–76; *J. Soc. Dyers Col.*, Nov. 1935, P. 400. (C)

FINISHING RAYON FABRICS. R. H. Wright. *Tex. Mfr.*, Jan. 1936, P. 10.

Describes embossing in the grey of rayon and mixture fabrics which controls the subsequent crêping and improves quality appearance. The article is accompanied by samples of the treated fabrics. (C)

FLAX AND HEMP WET SPINNING: MODERN THEORY AND PRACTICE IN. J. B. Pears. *Tex. Mfr.*, Feb. 1936, P. 45.

A review of principles and the various factors in wet spinning of flax or hemp. Changes in ideas and mechanisms. (C)

HUMIDITY REQUIREMENTS. J. L. Bitter. *Tex. Wld.*, Feb. 1936, P. 72.

Those for viscose- and acetate-process yarns in throwing, weaving, knitting and other processing are given and explained. Illustrated with absorption and other curves. (C)

IMITATIONS OF LINEN CLOTHS. R. P. Fullerton. *Tex. Mfr.*, Feb. 1936, P. 71.

"Linen" finishes on cotton goods and the production of imitations of linens. (C)

INSECT DAMAGE ON TEXTILES AND ITS CONTROL. H. Kemper. *Z. f. Kleintier u. Pelztier*, 1935, V. 11, P. 126–87.

An illustrated description of moths (clothes-moths, carpet moths and other varieties), larder-beetles (*Dermestes*, *Attagenus* and *Anthrenus* families), and other types of insects which damage textiles, leather etc. Methods and substances for control and prevention are described. The artiele contains a comprehensive bibliography and index. (From *J. T. I.*, Jan. 1936, P. A26.) (C)

KNITTING AND FINISHING: LABORATORY AS AN AID TO. Wm. T. Leggis. *Cotton*, Jan. 1936, P. 93. (C)

METHOD OF IDENTIFYING PRINTED COLORS. H. P. Baumann. *Tex. Mfr.*, Jan. 1936, P. 49.

The use of newer classes of colors for printing has made the existing methods of identification obsolete. A new scheme is suggested. (C)

OILING OF WOOL IN RELATION TO WORSTED SPINNING PROCESSES. J. B. Speakman. *Mell. Textilber.*, 1935, V. 16, P. 538–41; *J. Soc. Dyers Col.*, Nov. 1935, P. 401.

Addition of up to 1% oil to wool fibres minimizes breakage during subsequent mechanical treatments, *e.g.*, carding, and oleic acid (an emulsion of olein with Emulphor O) gives the best results. Although glycerine diminishes fibre breakage considerably, its detrimental influence on the carding process renders it unsuitable. The superiority of oleic acid over olive oil is attributed to its lower viscosity and greater spreading power. Additions of 3.5% oil increase mutual adhesion of the fibres to a maximum extent, and the even greater degree of adhesion necessary to facilitate subsequent drafting and spinning processes is secured by keeping for several weeks or months, during which period both the wool and the oil undergo a change. The alteration in the tension of stretched wool fibres which occurs on storage is a function of the R.H. and pH, and is due to hydrolysis of the cystein groups in the wool. As this proceeds more rapidly with alkali-treated wool than with acid wool or wool dyed with acid dyes, the latter is always more difficult to handle than the former. Contrary to expectation, it has been observed that *a*-naphthol in oils used for lubricating wool does not behave as an antioxidant, and more effective antioxidants must be discovered if arachis and similar non-drying oils are to be used for lubricating wool. The effect of certain dyes in accelerating oxidation of the oils is discussed, and the relation between their chemical constitution and catalytic effect is to be determined. (C)

PECTIN SIZE: APPLICATION. F. A. Kuteischtschikow. *Sa Rekonstruk. textilnoi. Prom.*, 1933, V. 12, No. 1, P. 33–9 (through *Chem. Zentr.*, 1935, ii, P. 620).

A 50–60% pectin size at 4° Bé. can be employed on medium counts for weaving on non-automatic looms at 50–65% R.H. and a temperature below 24° C. (From *J. T. I.*, Nov. 1935, P. A562.) (C)

RAYON CRÊPES COMPARED WITH SILK AND OTHER CRÊPES. J. Allen. *Tex. Col.*, Jan. 1936, P. 9–12.

A review of some of the physical properties of natural and synthetic fibres and yarns which are mainly concerned in the development of crêpe effects, and the effects of the properties of these various fibres and yarns upon the cloths containing them. Explains very clearly how a basicly complicated problem is further complicated when synthetic fibres and yarns are crêped. (C)

RAYON FABRICS: SHRINKING AND SLIPPING. F. S. Elsterberg. *Kunstseide*, 1935, V. 17, P. 311–7.

A discussion of the contraction of rayon fabrics on the loom and the use of temples to prevent contraction in width, shrinkage in finishing and washing processes, the swelling of rayon in water, the influence of preliminary stretching of rayon yarns and fabrics on their behavior in subsequent processing, and the slipping of rayon yarns in fabrics, the conditions influencing this slippage and methods of reducing it. (From *J. T. I.*, Nov. 1935, P. A583.) (C)

RAYON WEAVING: ESSENTIALS IN. W. Firth. *Tex. Mfr.*, Jan. 1936, P. 11.

Points in organization and tuning of looms, particularly in cases of conversion to the weaving of rayon. (C)

RAYON WEAVING PLANTS: REVIEW OF MODERN PRACTICES. H. W. Rose. *Cotton*, Feb. 1936, P. 83–7.

Methods of preparing and weaving viscose rayon are covered, with the making of crêpe yarn described in considerable detail. The need of careful control of humidity, temperature and tension in the various processes is emphasized. (C)

SEAM SHRINKAGE OF PRE-SHRUNK COTTON FABRICS. G. F. Young. *Tex. Mfr.*, Jan. 1936, P. 33.

Experience with pre-shrunk fabrics suggests that sewing construction and its handling in making-up needs attention. (C)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

AZOIC DYES ON VISCOSE RAYON. C. M. Whittaker. *J. Soc. Dyers Col.*, Jan. 1936, P. 6. (C)

AZOIC DYES ON SILK. C. M. Keyworth. *J. Soc. Dyers Col.*, Jan. 1936, P. 7. (C)

AZOIC COLORS IN CALICO PRINTING. R. J. Hannay. *J. Soc. Dyers Col.*, Jan. 1936, P. 7. (C)

AZOIC DYES AND BLEACHING. W. Kershaw. *J. Soc. Dyers Col.*, Jan. 1936, P. 9. (C)

AZOIC DYES FROM THE DYESTUFF MANUFACTURER'S VIEW-POINT. H. Blackshaw. *J. Soc. Dyers Col.*, Jan. 1936, P. 9. (C)

AZOIC DYEINGS FROM THE DYESTUFF MANUFACTURER'S STANDPOINT. A. F. Williams. *J. Soc. Dyers Col.*, Jan. 1936, P. 10. (C)

BLEACHING PROCESS. O. Mecheels. *Mell. Textilber.*, 1935, V. 16, P. 725–9.

Catalytic injury to cotton during bleaching with hydrogen peroxide is due to the presence of heavy metals and their compounds, particularly iron. The activation of hydrogen peroxide by iron salts is attributed to intermediate formation of a higher oxide or peroxide, probably Fe_2O_5, which decomposes spontaneously into ferric oxide and active oxygen, the latter being responsible for oxycellulose formation. It is clear, therefore, that if catalytic injury during bleaching is to be avoided, the goods must be free from rust or other deposits of iron, the water must not contain iron salts, and the goods must not be allowed to come in contact with iron vessels or pipes during bleaching. If the goods already possess iron stains, or the water contains iron salts, injury can only be minimized by diminishing the rate of reaction, *e.g.*, by adding stabilizers, or by bleaching at a lower temperature or under less alkaline conditions. Examination of the action of the different bleaching processes on the lustre and softness of vegetable fibres has indicated that the peroxide bleach produces softer goods, while those bleached with chlorine retain a better lustre. A combined bleach gives the best whites. In bleaching cotton and cotton-vistra unions with hydrogen peroxide, the best results are obtained by raising the temperature to 80° C. as quickly as possible, and then slowly to the boil. (From *J. Soc. Dyers Col.*, Dec. 1935, P. 430.) (C)

BLEACHING SOLUTIONS: NEW METHOD OF DETERMINING ACTIVE CHLORINE IN. H. Drageant. *Rev. Gen. Tein. Imp. Blanch. App.*, 1935, V. 13, P. 715–9; *J. Soc. Dyers Col.*, Feb. 1936, P. 78. (C)

CAUSES OF VON ALLWÖRDEN'S REACTION. K. Stirm and H. Collé. *Mell. Textilber.*, 1935, V. 16, P. 585–6, 667–8, 795–8; *J. Soc. Dyers Col.*, Feb. 1936, P. 73. (C)

CELLULOSE: ACTION OF ELEMENTARY AND ACTIVE OXYGEN ON—ON THE BASIS OF VISCOSITY DETERMINATIONS. E. Scheller. *Mell. Textilber.*, 1935, V. 16, P. 787–91.

Determinations of the viscosity in cuprammonium solution have indicated that cotton cellulose is unaffected by treatment with alkalis even at high temperatures, if oxygen is entirely absent, but addition of oxidizing agents or introduction of air accelerates degradation of cellulose. Elementary oxygen itself, in absence of alkali, also has no influence on cellulose, and the extent of degradation of the latter, in presence of alkali,

depends on the temperature, method of circulation of the liquor, and concentration of the alkali. Extensive tendering of cotton fibres during bleaching with hdyrogen peroxide, or other compounds yielding active oxygen, can be avoided by carefully controlling these conditions. (From *J. Soc. Dyers Col.*, Feb. 1936, P. 76.) (C)

CHEMICALS AND WOOL. Fredk. R. Harrison. *Tex. Wld.*, Feb. 1936, P. 70.

Effects of various dyeing treatments on tensile strength of worsted yarn are described. (C)

CHROMIUM MORDANTS IN TEXTILE DYEING AND PRINTING. S. L. Segson. *Can. Chem. Met.*, 1935, V. 19, P. 268–9; *C. A.*, 1936, V. 30, Col. 290. (W)

COLOR TOLERANCE: ITS MEASUREMENT AND SPECIFICATION FOR DYED TEXTILES. Robert D. Nutting (Textile Foundation Fellow). *Tex. Esch.*, Dec. 1935, P. 104; *Am. Dye. Rptr.*, Jan. 13, 1936, P. 1. (C)

CONDITIONING WATER FOR THE TEXTILE INDUSTRY. H. H. Morrison. *Am. Dye. Rptr.*, Jan. 27, 1936, P. 43.

The processes and equipment employed in conditioning water for the textile industry are briefly described. (C)

DELUSTERING RAYONS. A. Herzog. *Mell. Textilber.*, 1935, V. 16, P. 829–44.

The most important substances recommended for use in delustering rayons, and methods for their identification on the fibre, are reviewed. (From *J. Soc. Dyers Col.*, Feb. 1936, P. 77.) (C)

DYEING ANIMAL FIBRES: THEORY OF. A. Porai-Koshitz. *J. Soc. Dyers Col.*, Jan. 1936, P. 19.

The experiments described are held to support the view that the dyeing of animal fibres with acid and substantive dyes is a process of formation of definite salts from the fibre as base and the dye as acid. (C)

DYEING MACHINERY: FURTHER NOTES ON THE SUITABILITY OF METALS FOR. J. G. Grundy. *J. Soc. Dyers Col.*, 1935, V. 51, P. 377–84; *C. A.*, V. 23, P. 2829; 1936, V. 30, Col. 617. (W)

DYEING OPERATIONS: CONSUMPTION OF HEAT IN. Otto Th. Koritnig. *Spinner u. Weber*, 1935, V. 53, P. 278–9; *C. A.*, 1936, V. 30, Col. 290. (W)

DYEING WOOL AT TEMPERATURES BELOW 100° C. E. Elöd. *Mell. Textilber.*, 1935, P. 584–5.

Dyeing theories are discussed with particular reference to the turbulent process of wool dyeing (cf. Rendell and Thomas, *Ibid.*, 1935, V. 51, P. 157). Incomplete penetration of heavier woolen goods in dyeing by the normal process with fast-to-milling acid dyes is due either to the particle size and low rate of diffusion of the dyes within the fibre, or to the too rapid rate of reaction between the wool protein and the dye particles. The improved

penetration and more even dyeings obtained when wool is dyed by the turbulent process are not considered to be due to the powerful agitation of the dye liquor by the current of air introduced, but to the relatively slower rate of reaction between the dye particles and the wool protein at the low temperature of the dyebath, which enables the dye particles to penetrate more uniformly and more deeply into the fibre before they are fixed by it. (From *J. Soc. Dyers Col.*, Dec. 1935, P. 431.) (C)

FAST WOOL DYEINGS WITH PARTICULAR CONSIDERATION OF THE CLOTH SUPPLIED. H. Brandenburger. *Monatschr. Textil-Ind.*, 1935, V. 50, P. 243–6.

Dyeing expts. were carried out with various Cr and vat dyes. Measurements were made of the strength and elasticity (dry and wet) of the Cr and vat-dyed wool. Studies were made of the effect of the addn. of fibre preservatives on the strength and elasticity of Cr-dyed textiles. The results show that the differences between Cr and vat dyeings are very slight and that the preservatives used increase both the strength and the elasticity. Detailed dyeing directions are given and the results obtained are tabulated. (From *C. A.*, 1936, V. 30, Col. 290.) (W)

FINISHING OF BLANKETS: NEW METHODS OF—BY MEANS OF FATTY ALCOHOL SULFONATES. W. Pflumm. *Spinner u. Weber*, 1935, V. 53, No. 38, P. 9–12.

Photomicrographs show wool damaged by alkalies, damages caused by the formation of Ca soap, and the appearance of a carefully washed woolen blanket. Detailed directions are given for washing and rinsing involving the use of Gardinol which was found to give very good results. (From *C. A.*, 1936, V. 30, Col. 292.) (W)

FINISHING OF PURE RAYON FABRICS. Wilhelm Kegel. *Deut. Wollen-Gewerbe*, 1935, V. 67, P. 1249–50.

Various formulas and sp. directions are given for sizing, treatment after bleaching and dyeing, finishing mixed fabrics from rayon and cotton, and printing and steaming of rayon fabrics. Strong alkali baths should not be employed for washing. A newly developed com. finishing product is Ortoxin K which is easily sol. in boiling water, is particularly adapted for the finishing of mixed fabrics from rayon and cotton and is employed in a concn. of 30–60 g./l. at a temp. of 30–35°. (From *C. A.*, 1936, V. 30, Col. 292.) (W)

HYPOSULFITE GLUCOSE VAT: ADVANTAGES OF THE. H. Korb. *Monatschr. Textil-Ind.*, 1935, V. 50, P. 246.

The mixt. contained 30 g. indanthrene blue RS, 100 g. NaOH 30°–Bé. and 3.5 g. concd. hyposulfite per l. of H_2O with or without glucose. Pieces of cotton were subjected to six dyeings. (From *C. A.*, 1936, V. 30, Col. 291.) (W)

JUTE INDUSTRY: UTILIZATION OF WASTE IN THE. Hans Rudolph. *Spinner u. Weber*, 1935, V. 53, No. 35, P. 8–10; *C. A.*, 1936, V. 30, Col. 290. (W)

IV. Research Methods and Apparatus

Reflectometer—Priest-Lange: Applied to Nearly White Porcelain Enamels. *B. S. J. Rsch.*, Nov. 1935, P. 529–50.

The Priest-Lange reflectometer is described in detail and the theory of its use given for determining relative apparent reflectance for various spectral distributions of illumination. A method for measuring spectral selectivity of reflectance is also described together with a method for measuring diffuse-plus-specular reflectance as distinguished from diffuse reflectance alone for perfectly polished specimens. (C)

Textile Testing Laboratories. Robert H. Brown. *Cotton*, Jan. 1936, P. 48.

An authoritative discussion that will interest those actively engaged in and concerned with textile testing; covering some of the more recent and advanced applications of more accurate control of conditions, and recently established and approved principles and methods. (C)

Raw Silk: Triple Gage Testing Machine for. *Am. Silk & Rayon J.*, May 1936, P. 22.

Describes the new machine for testing cleanness and evenness of raw silk developed for and approved by the raw silk committee of the National Association of Hosiery Manufacturers. The silk passes sequentially through cages of 0.0004 in., 0.0003 in. and 0.0002 in. diameter. (C)

Reflectance Measurements: Note on the Effect of a Cover Glass in. D. B. Judd and K. S. Gibson. *B. S. J. Rsch.*, March 1936, P. 261–4.

It has been found from theoretical considerations that the use of a cover glass may result in an error of as much as 10% when two diffusing surfaces, one light and one dark, are compared for apparent reflectance. The error arises from multiple reflections between sample and cover glass, the lighter sample obtaining much more added illumination from this cause than the darker. The error depends on the angular distribution of the illuminant, the angle of view, and the diffusing characteristics of the samples as well as their reflectances. (C)

Stress-extension Recording Dynamometer for Textile Fibres. D. de Meulemeester and I. Nicoloff. *J. T. I.*, Mar. 1936, P. T84–7.

A description is given of a self-recording dynamometer for textile fibres that records the load and the extension mechanically on diagrams with rectangular co-ordinates, without error due to the extension of the fibre or to friction of the recording apparatus. (C)

Tensile Testing Machines: Recent Developments in. David C. Scott. *Am. Dye. Rptr.*, Mar. 11, 1935. (C)

Textile Viscometry. Pegasus. *Tex. Col.*, April 1936, P. 227–31, 282.

Describes various viscometers that may be used for determining viscosity of oils and other textile processing materials, the viscosity of textile fibres, and viscosity as a measure of the chemical degradation of textile fibres. (C)

TUNING-UP MANAGEMENT. Anon. *Tex. Wld.*, April 1936, P. 78–81.

Review of new raw materials, products, machines and manufacturing and merchandising methods. (C)

UNIFORMITY OF THREADS AND YARNS: METHODS AND APPARATUS FOR THE DETERMINATION OF THE. H. Ottensmeyer. *Monatsh. Seide Kunstseide*, 1935, V. 40, P. 372–8, 411–14.

A review dealing with optical, volumetric, weighing, strength and elongation methods and the app. employed. Many illustrations are shown. (From *C. A.*, 1936, V. 30, Col. 1567.) (W)

VISCOSITY: DETERMINATION OF—BY OSCILLATION OF A VESSEL ENCLOSING A FLUID. E. N. da C. Andrade and L. Rotherham. *Phys. Soc., Proc.* 48, P. 261–6, March 1, 1936.

A new method for carrying out the oscillating-sphere method is described. The sphere carrying the liquid carries a small, permanent magnet, at the centre of a Helmholtz coil system. A condenser, discharged through the coils once in every complete swing, supplies the energy dissipated by the viscous forces, and so maintains a constant amplitude. Measurement of this amplitude, and of the potential of the condenser, enables comparative measurements of viscosity to be accurately made. The method has been checked by measuring the viscosity of hexane in terms of that of water. Absolute measurements are possible by the method, but have not been carried out. (From *Science Abs.*) (X)

WATERPROOFED TEXTILES: A NEW APPARATUS FOR THE EVALUATION OF. Bundesmann. *Mell. Textilber.*, 1935, V. 15, P. 128–31, 211–13, 331–2, 663–4, 739–40, 792–4.

The app. works on the following principle: The test pieces of the waterproofed fabrics are subjected to a continuous spray of rain from above, while being wiped at the same time by rubber wipers from below. The amt. of moisture taken up by the test piece is detd., as is the amt. going through the test piece. The testing equipment and method is described and illustrated. (From *C. A.*, 1936, V. 30, Col. 1236.) (W)

WEARING QUALITY: PRACTICAL TESTS OF THE—OF POROUS MIXED FABRICS WHICH HAD BEEN RENDERED IMPERVIOUS TO MOISTURE BY IMPREGNATION. Fritz Ohl. *Spinner u. Weber*, 1935, V. 53, No. 49, P. 12, 14, 16–7; *C. A.*, 1936, V. 30, Col. 1569. (W)

WOOD'S LIGHT AND ULTRA-VIOLET LIGHT: APPLICATION IN THE TEXTILE INDUSTRY. M. Déribéré. *Tiba*, 1935, V. 13, P. 173–5, 259, 329–31, 415–7, 481–5, 547–9, 607–11, 687–91.

A general discussion of the use of Wood's light and ultra-violet light for the identification of textile fibres, the examination of stains and other faults, the oxidation of reduced dyes in discharge printing, the determination of the fastness of dyes, the examination of finishing compounds and assistants, and the selection of silkworm eggs, and in chemical analyses, pH determinations, and the testing of waterproofed fabrics. (From *J. T. I.*, Feb. 1936, P. A76.) (C)

WOOL FIBRES: NEW EXACT METHODS FOR MEASURING. Herman Rausch. *Tex. Recdr.*, Mar. 15, 1936, P. 36.

Instruments for measuring fineness, elasticity and color are described. For measuring the diameter of single hairs he advocated the lanometer developed by Dochner, which consists of a light source, a frame for the object, a microscope and a case fitted with a projection field. The enlargement is bound to be constant owing to the fixed distance between the projection field and the object. The apparatus is set to enlarge 500 times.

It is usual to test wool or tops by compressing the wool in the hand and letting it go again to find out whether it is elastic or dead. An apparatus has now been constructed which will measure this property. It comprises a pendulum which, by means of a lever system, is capable of compressing material disposed in a segment-like test space by means of a piston during oscillation, the compression of the test piece being effected while the pendulum swings to the left.

For comparing the color of wool or tops the author describes an apparatus which has been specially constructed to meet the requirements of the woolen industry. The material to be tested is illuminated by light having an angle of incidence of 45° relative to the surface, the light scattered vertically to its surface being then measured. A low voltage lamp serves as the source of light, and a condenser is employed for increasing brightness. The scattered light is measured by a photo-electric cell with an intercepting layer, the degree of brightness of the lamp being chosen so that the photo-electric current can be conveniently read at a galvanometer. (C)

WOOL YARNS: DETERMINING THE AVERAGE FIBRE LENGTH IN. L. B. Walton. *Science*, Apr. 10, 1936, P. 353.

If the fibres are not under longitudinal tension due to spinning, the average length (l_2) is indicated by $l_2 = 2\ (s/\sin\theta)\ n/e$. Hereby is (s) the length of any sample, (n) the number of fibres in a cross-section, (e) the average number of ends and (θ) the pitch of the helix. If the fibres are under tension, the average length (l_3) is found to be $l_3 = 4\ sn \cdot \tan^2\theta\ (\csc^2\theta - 1)/3e$. Experiments with fibres of known length are stated to be closely in agreement with the theoretical values. (X)

V. ECONOMICS, PHYSICS AND MISCELLANY

COTTON TEXTILE INDUSTRY: DEVELOPMENT OF THE—OF THE UNITED STATES FROM 1920 TO 1930. G. Gordon Osborne. *J. T. I.*, 1936, Jan., P. P4–21; Feb., P. P30–38.

Due to the advantages offered by the South, these here discussed plus others, it seems that any expansion in the cotton industry or the replacement of old enterprises will not take place in the North. New mills when there is a demand for them will be built in the South; and as time goes on, conditions remaining the same, there will be a tendency of northern mills to drop out altogether or move southward. No doubt that New England will retain a considerable portion for her cotton industry, especially that devoted to specialization, but from this investigation it seems that the future of the cotton manufacturing industry lies in the South. (C)

SCIENTIFIC TEXTILE RESEARCH: ERA OF. ITS BACKGROUND AND FUTURE. Charles H. Clark. *Tex. Bull.*, Mar. 5, 1935, P. 42–3, 130–2. (C)

LITERATURE: SEARCHING CHEMICAL AND ALLIED. D. D. Berolzheimer. *The Chemist*, Feb. 1936, P. 426–33.

In a talk given before the New York Chapter of the Am. Inst. of Chemistry, a chemical literature expert discusses the procedure by which chemical and other technical literature is searched, and the qualifications necessary to do this successfully. (C)

PARACHOR, SURFACE TENSION AND DENSITY OF SUBSTITUTED PHENOLS AND PHENOLIC ETHERS. A. Burawoy and I. Markowitsch-Burawoy. *Chem. Soc. J.*, P. 35, Jan. 1936.

In continuation of previous work on the constitution of the so-called o-hydroxy-azo-benzenes, the parachors, surface tensions, and densities of the hydroxy-azo-benzenes and hydroxy-benz-aldehydes and their methyl ethers are investigated. They are discussed in relation to the same properties of the nitrophenols and anisoles as given among or calculated from Jaegers data. The determined parachors of the o-hydroxy-compounds are low in comparison with the theoretical values and with those of the corresponding m- or p-hydroxy-compounds, but the methyl ethers in each series do not show these differences. This cannot be attributed to association. The results are further discussed in some detail. (From *Science Abs.*) (X)

ULTRA-SONIC WAVES: EMULSIFICATION BY. C. Bondy and K. Söllner. *Trans. Faraday Soc.*, 1935, V. 31, P. 835–46; *J. T. I.*, Sept. 1935, P. A472. (C)

A National Rayon Conference

U. S. INSTITUTE has been invited by the Textile Division of the American Society of Mechanical Engineers to join them, the A. A. T. C. C. and Committee D-13 of the A. S. T. M., in sponsoring a National Rayon Technical Conference to be held in Washington, D. C., May 14, 15, 1937. Official delegates of these organizations conferred June 15, U. S. Institute being represented by P. A. Johnson and Dr. H. DeW. Smith. The latter committee will report to a meeting of the Board of Directors Sept. 23. A meeting of the sponsors of the conference will be held Sept. 28 to complete the program and other details. Originally, this conference was to have been held next fall in celebration of the "25th anniversary of the rayon industry." Possibly the date was changed to avoid so controversial a subject.